sPHENIX Calorimeter Test Beam At FNAL

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Data Analysis

I spent most my time at Fermilab analyzing the EMCal position scan data

All codes and analysis results can be found in

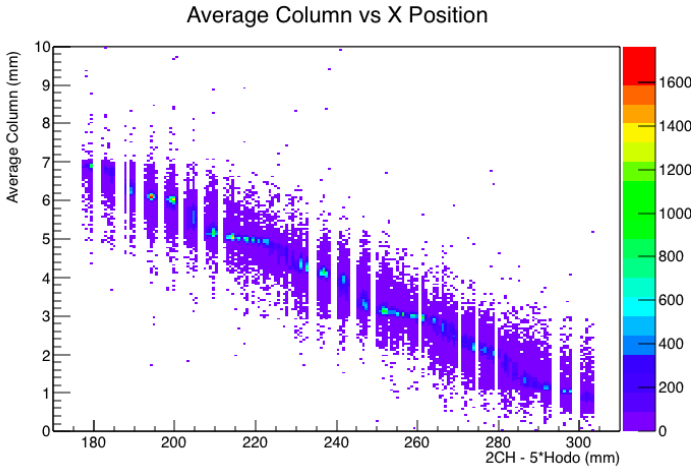
https://github.com/sPHENIX-Collaboration/analysis/tree/master/Prototype3/EMCal/EMCALPositionScanCodes

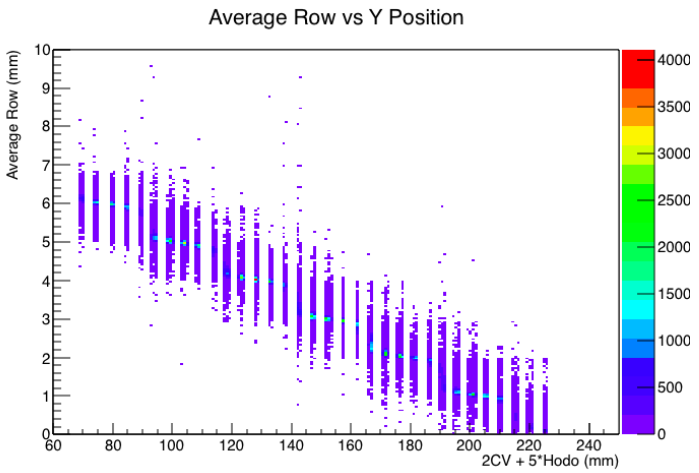
Run the EMCalAnalysis.csh to perform the analysis

Data Analysis (Before Recalibration)

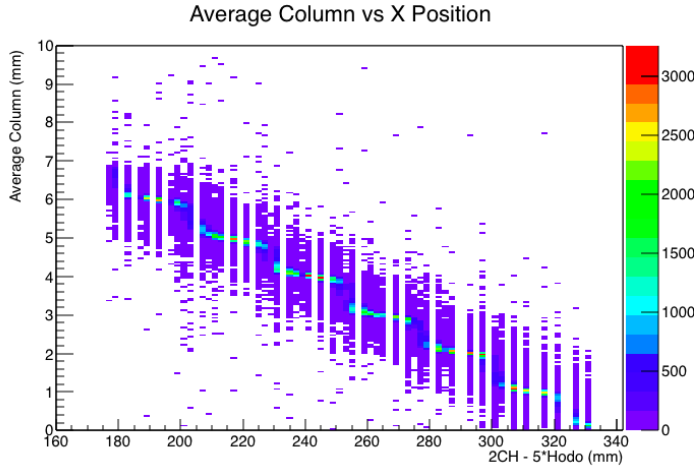
Step 1. Study the sign of the correct of hodoscope to the horizontal and vertical position of the towers (Code: PlotEnergy.C)

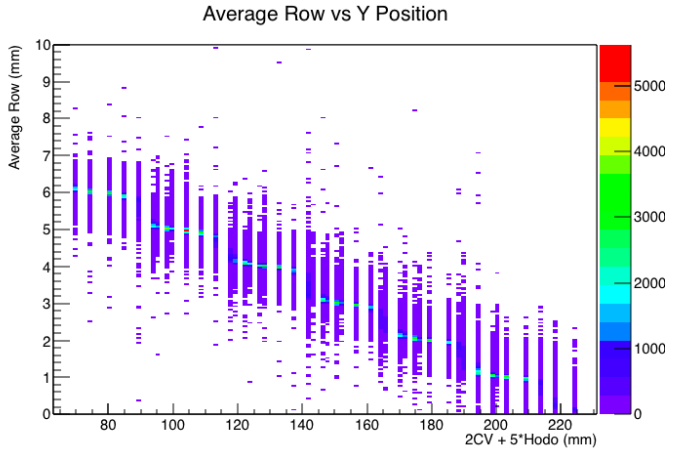
-10° Results:





0° Results:



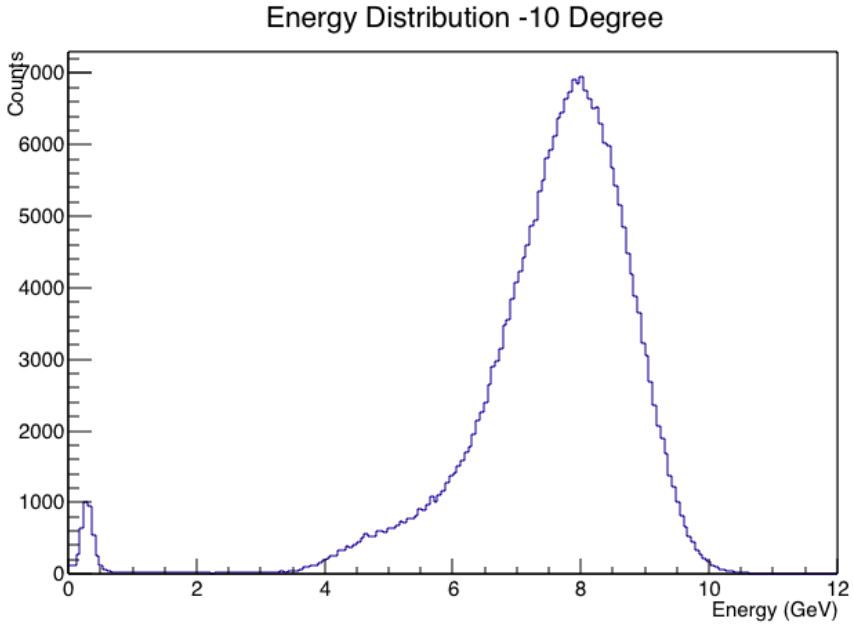


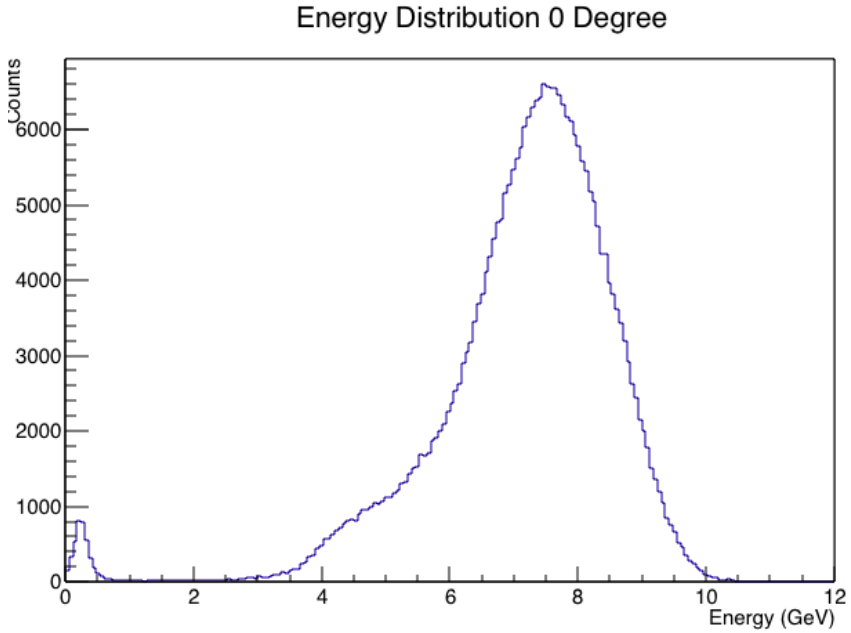
The sign of horizontal hodoscope is – while the vertical hodoscope is +

Data Analysis

Step 2. Create a 3 dimensional histogram for the energy distribution of each hodoscope corrected x and y positions of each tower with the selection of valid horizontal and vertical hodoscope with No-Trigger Veto and Cherenkov counter > 200. Total positions bins = 36 × 64 = 2304 (Code: FillEnergy.C)

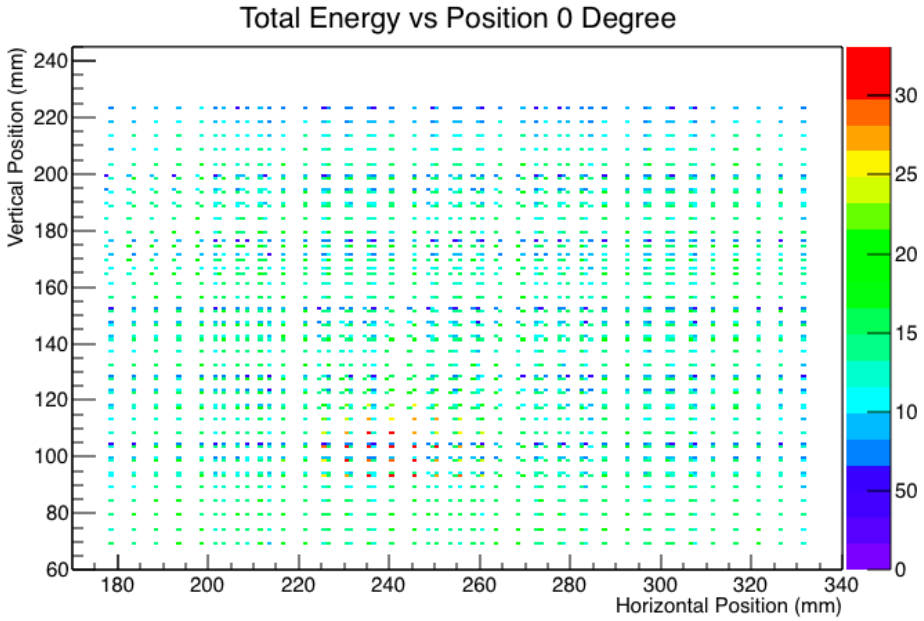
Energy Distribution from-10° and 0° measurements for all points

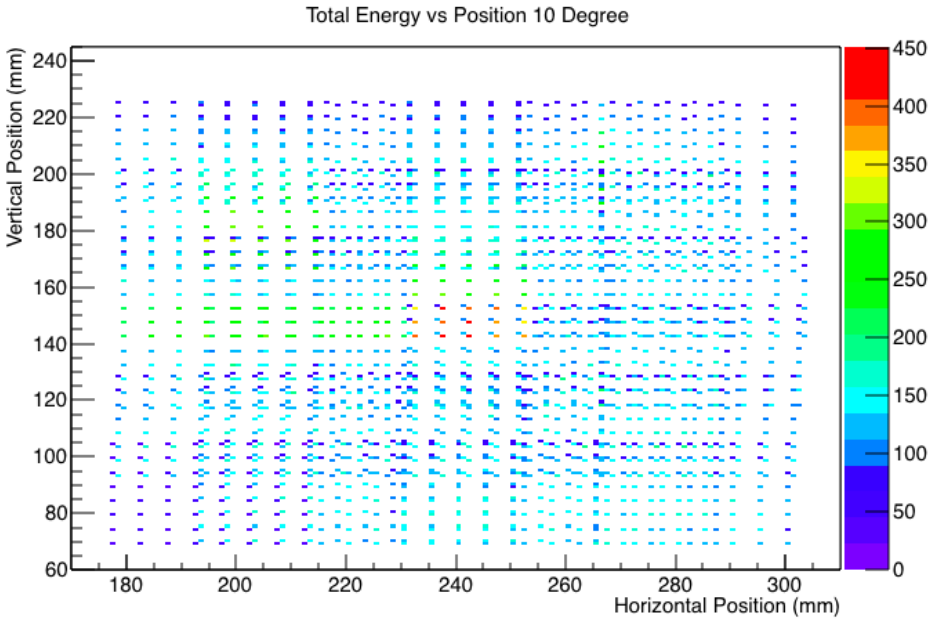




Data Analysis

Energy vs Position Plots from 0° and -10 ° measurements

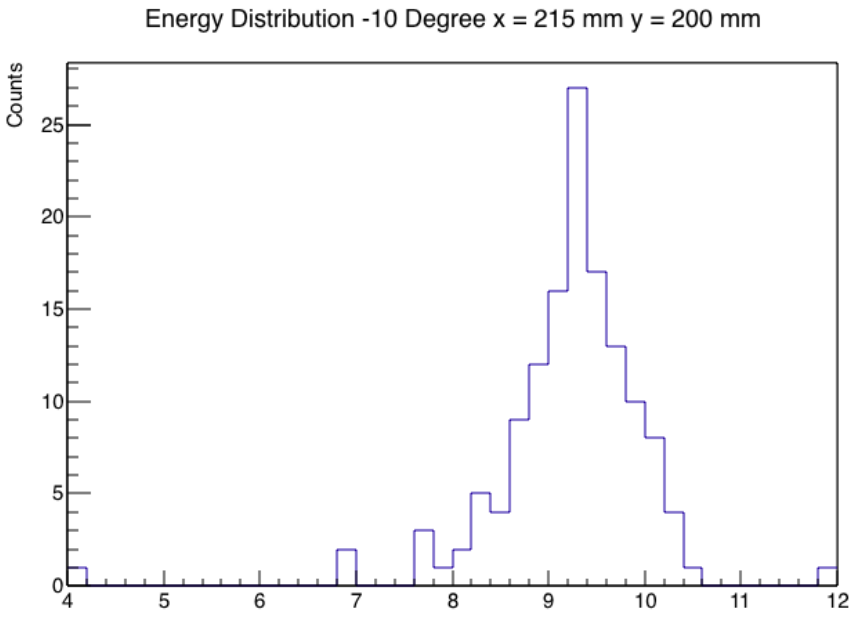


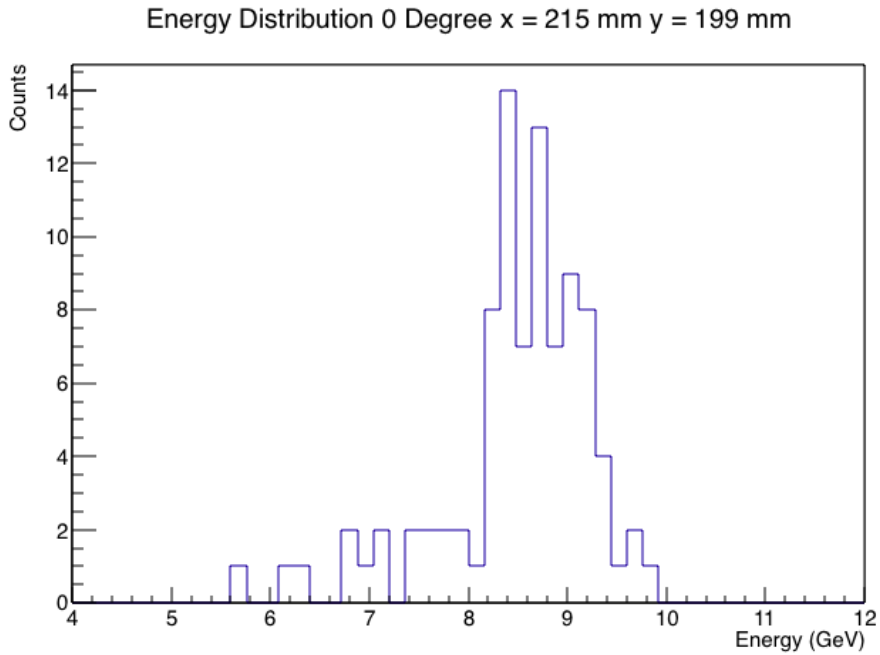


Data Analysis

Step 3. Project the 3 dimensional histogram to each hodoscope corrected positions bins (2304 bins in total) and fit the energy distribution with Gaussian function to obtain the mean value of the energy distribution of each bin. Plot them into a 2 dimensional x – y position histogram. The z axis is the mean energy value. The energy range is from 5 - 10GeV. (Code: ReadHis.C)

Examples of energy distribution of regular towels (E_{mean}~8 GeV):

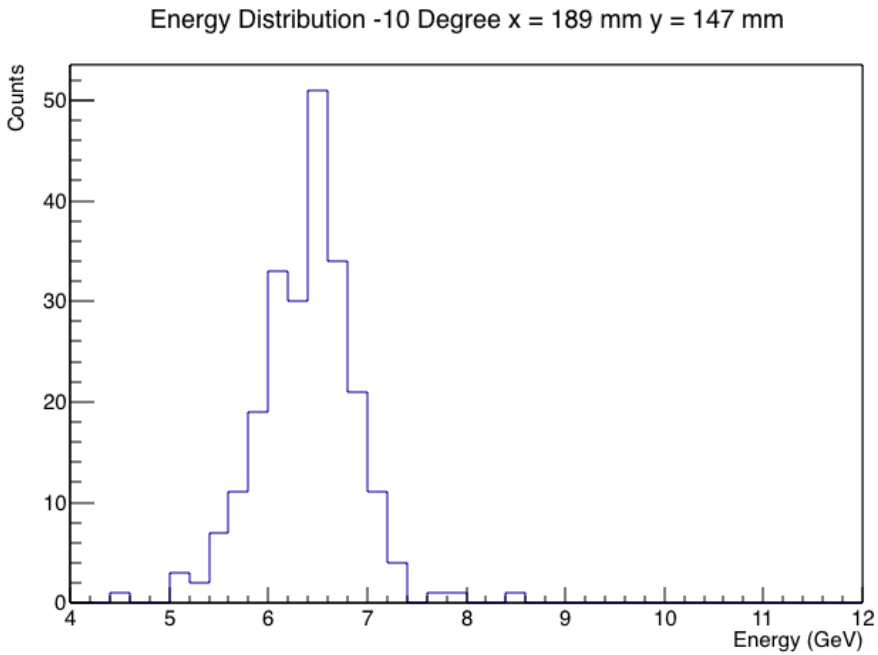


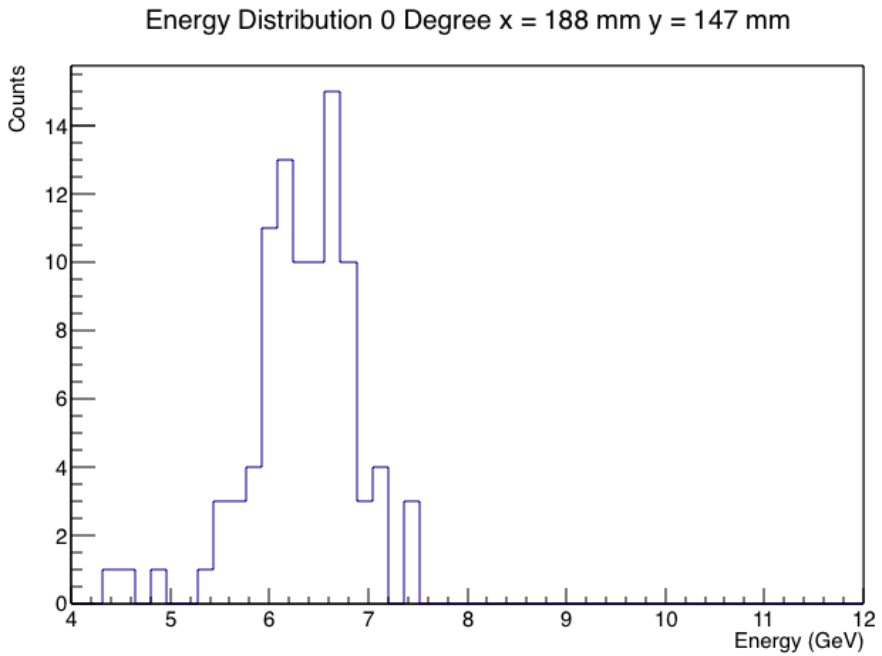


Barely enough statistics to do a Gaussian fit to extract the mean energy

Data Analysis

Examples of energy distribution of towels [E_{mean}~6 GeV, Tower (6,3)]:

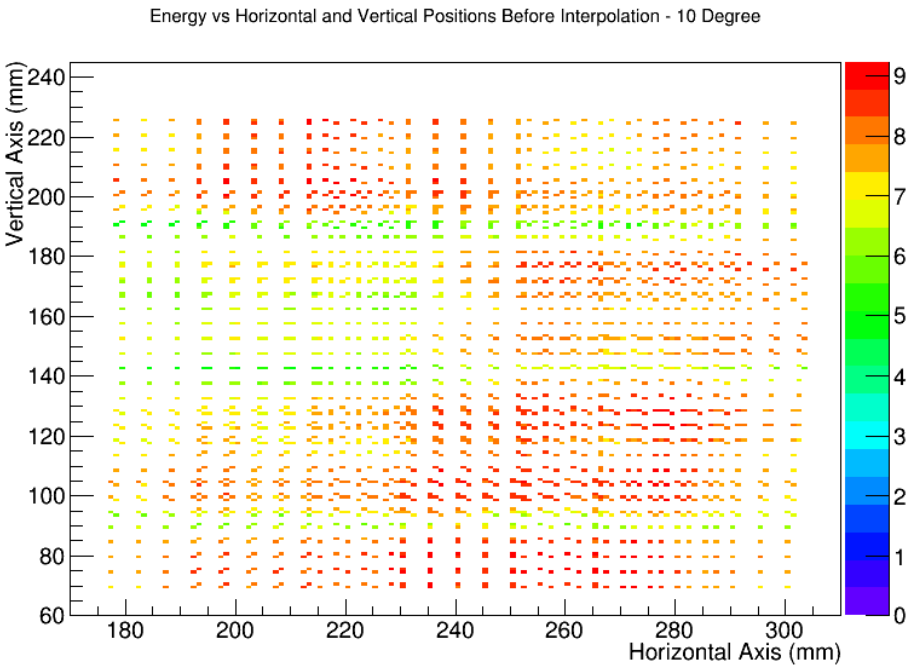


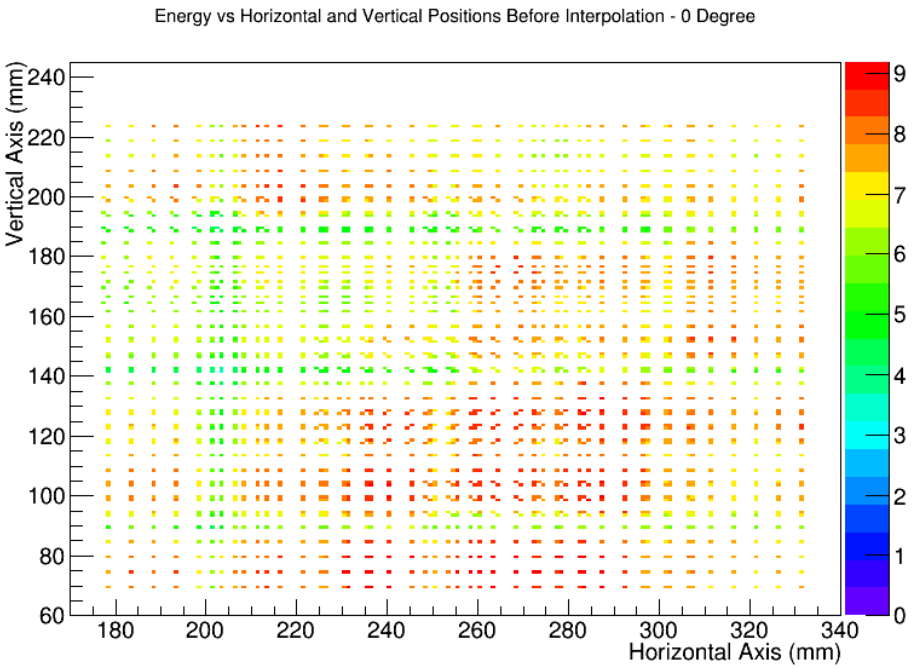


Obviously, we can see that the energy at Tower (6,3) is lower than other towels. Maybe it is because of the EMCAL calibration.

Data Analysis

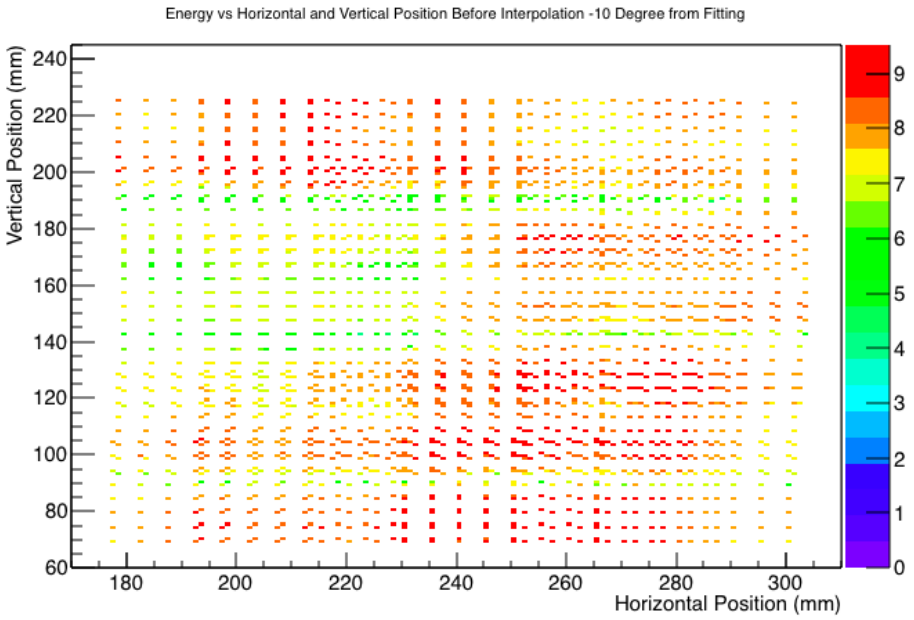
Results for all points from mean extraction:

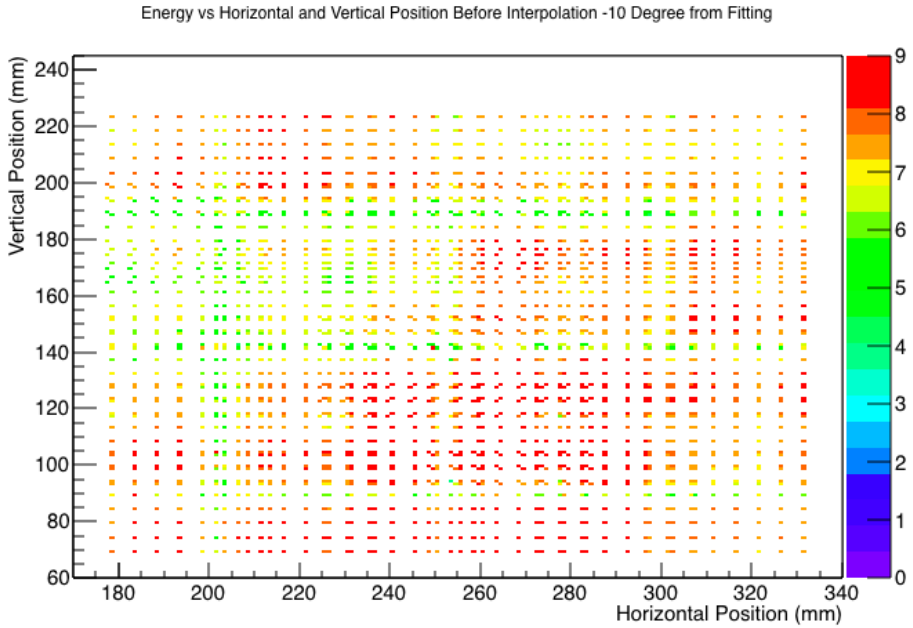




Data Analysis

Results for all points from Gaussian fitting extraction:



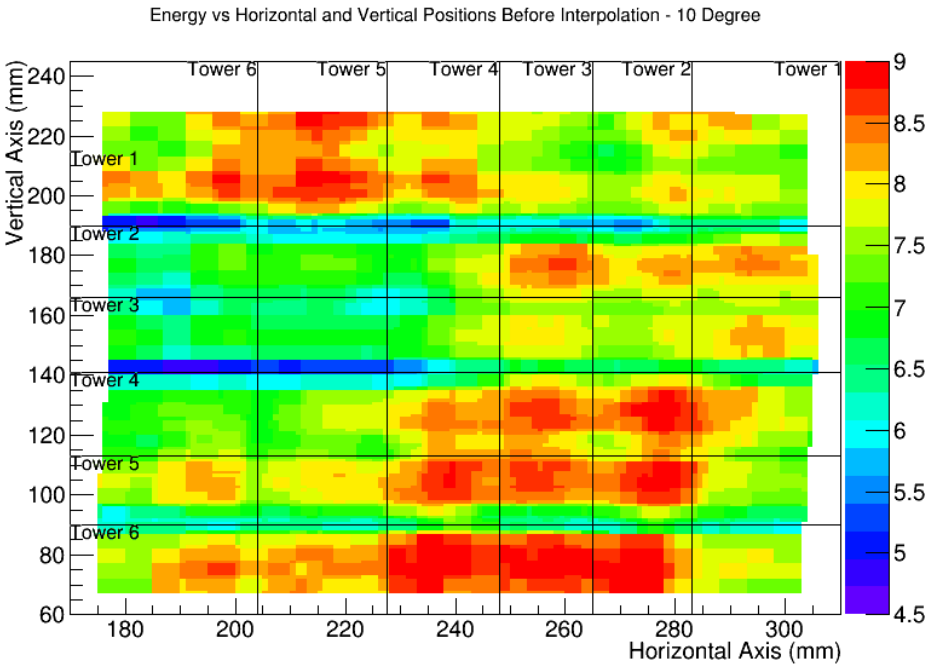


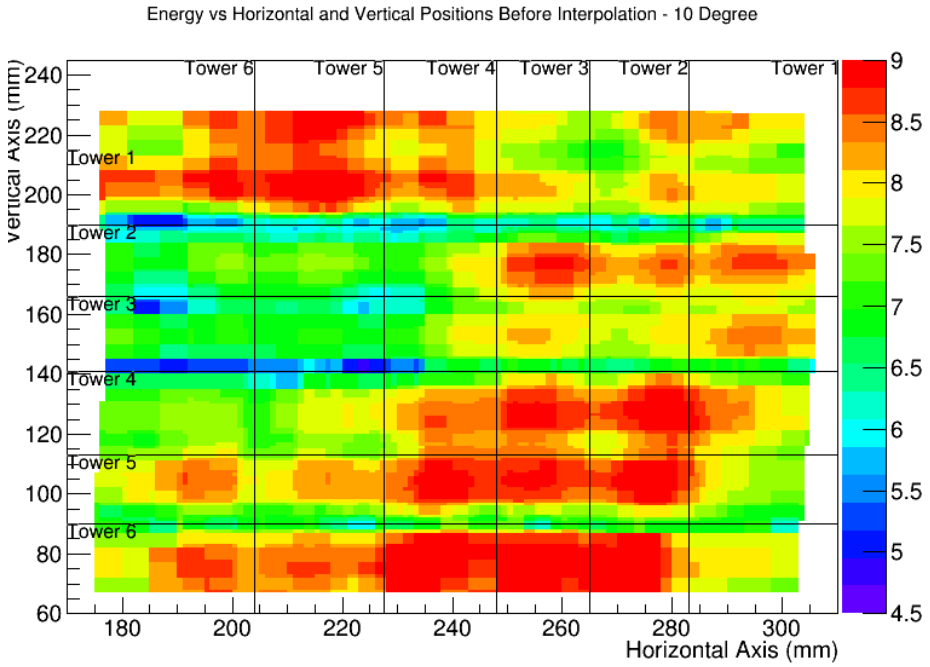
We can see that the mean energy vs x-y position plot using the mean value method and using the Gaussian fitting are very similar.

Data Analysis

Step 4. Average the non-zero values bins in 5 by 5 bins to interpolate the zero value bins to make the energy distribution to be continuous (Code: Interpolate0Degree.C)

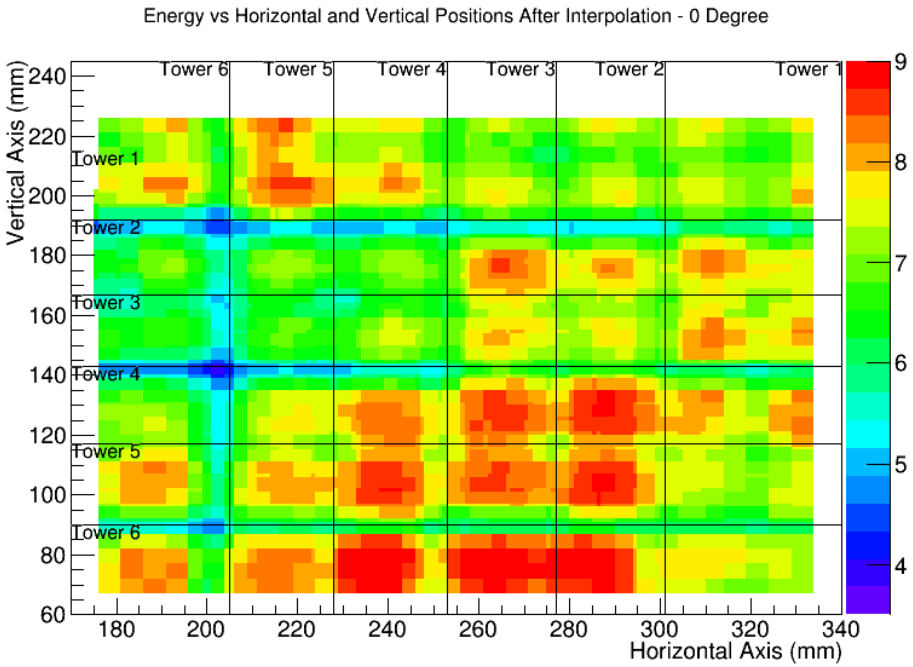
-10° Results (Left uses Getmean and right uses fitting)

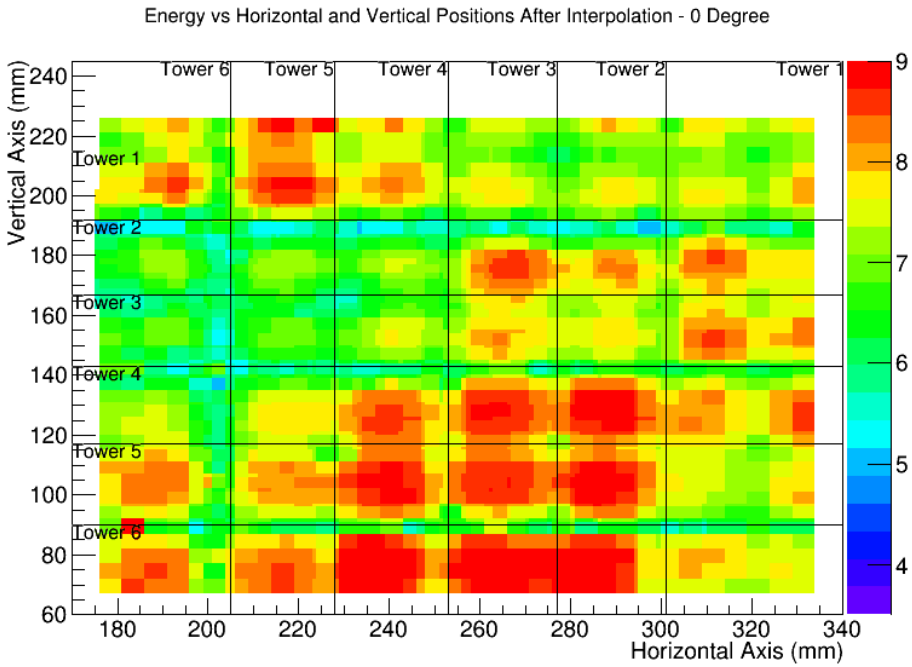




Data Analysis

0° Results (Left is mean-value method and right is fitting method)

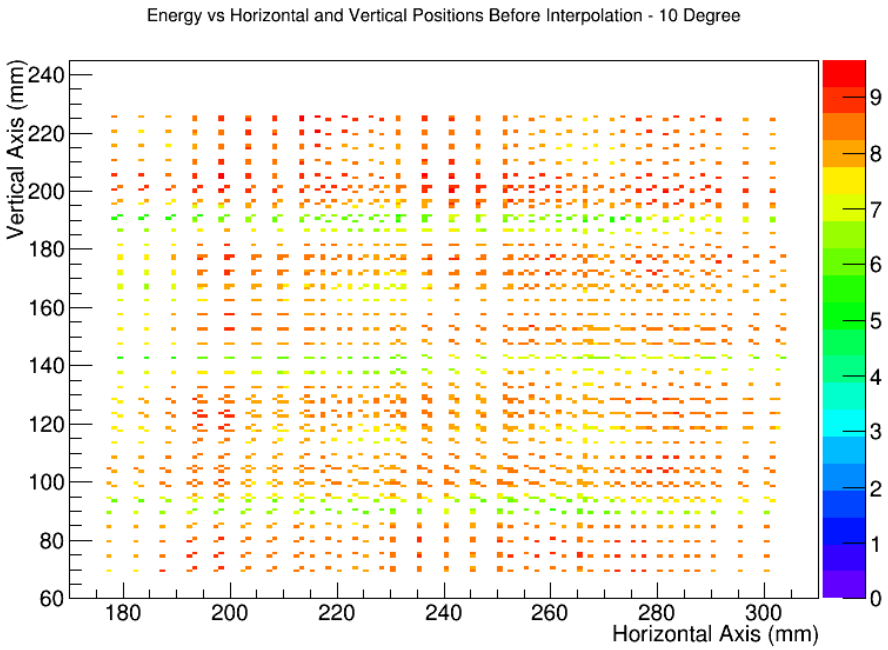


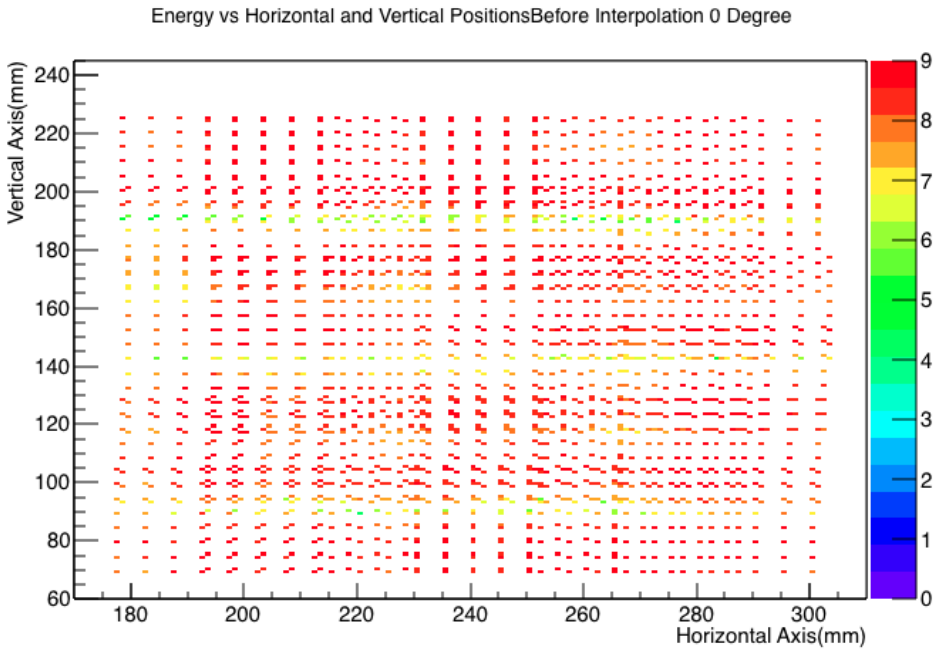


New Results (After ReCalibration)

Recalibration is done by Jin Huang.
Change **clus_5x5_prod.sum_E** to **clus_5x5_recalib.sum_E** in MakeFile.C

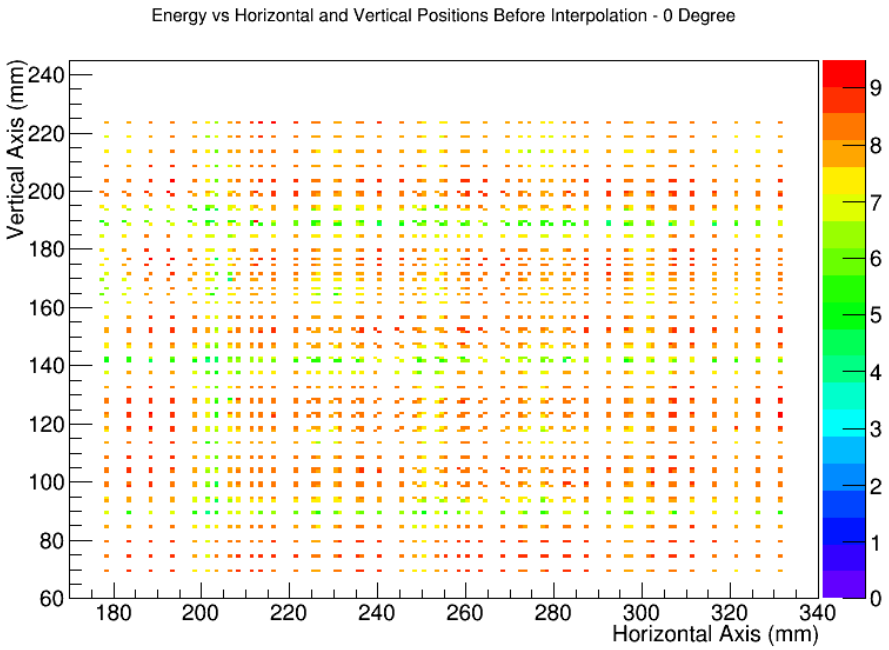
-10° Results (Left is mean-value method and right is fitting method)

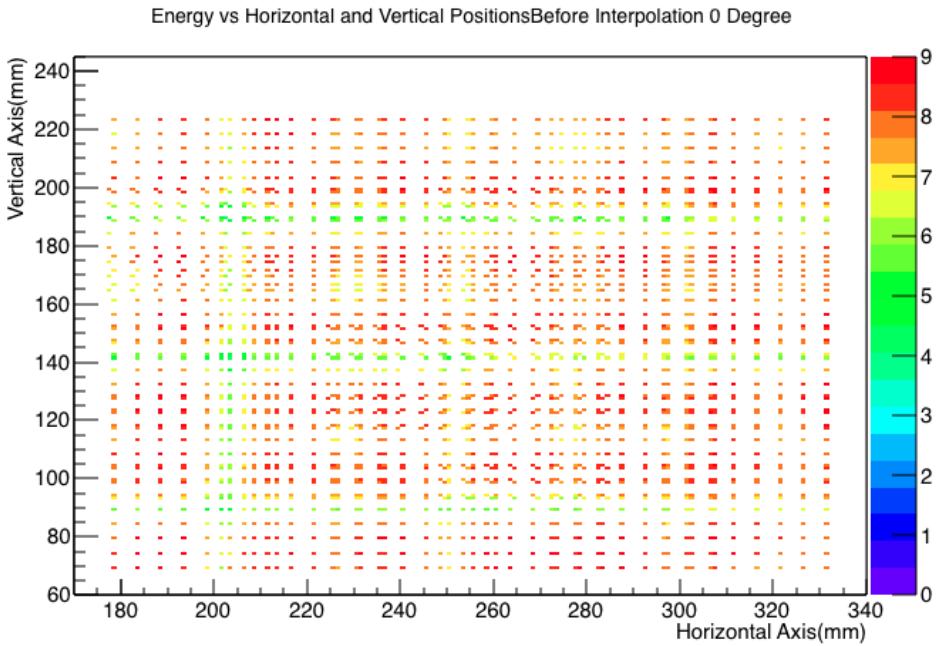




New Results (After ReCalibration)

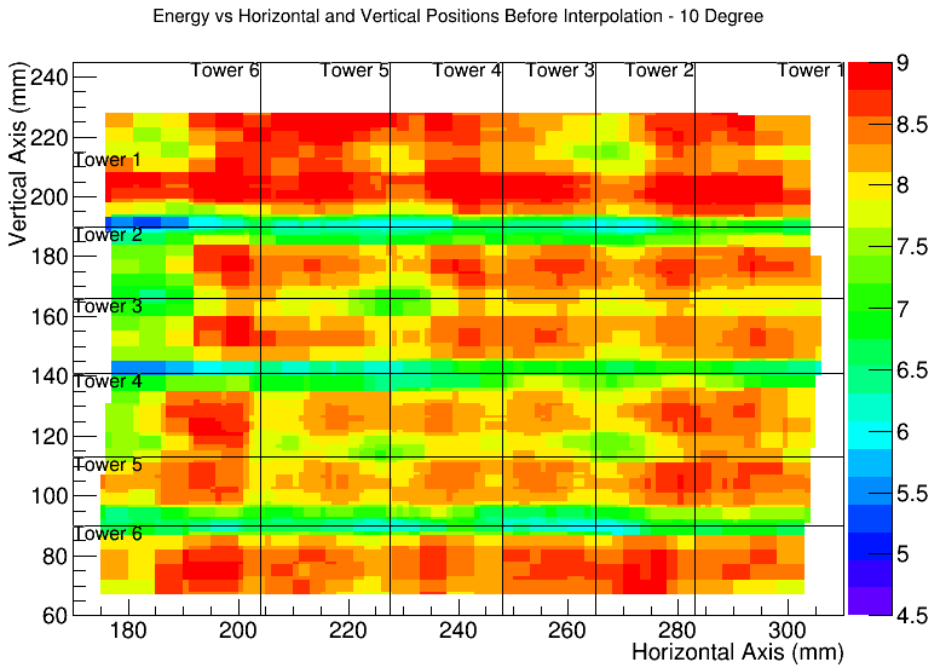
0° Results (Left is mean-value method and right is fitting method)

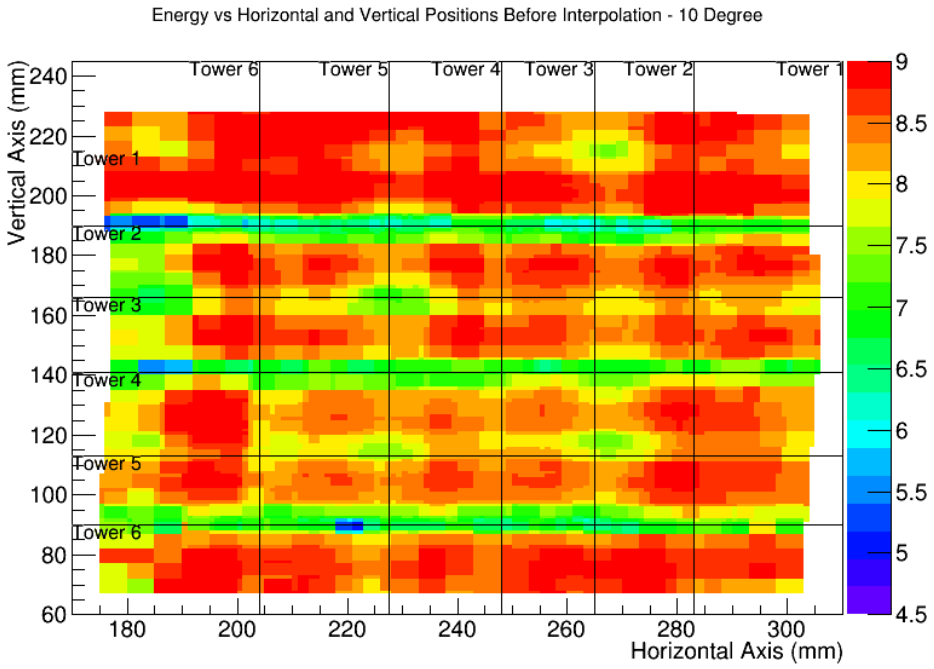




New Results (After ReCalibration)

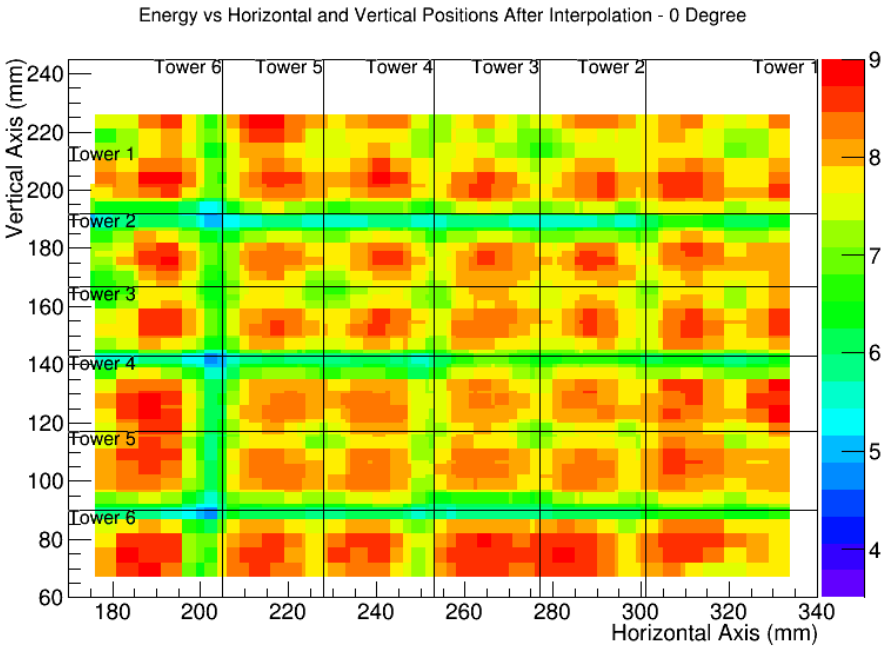
-10° Results (Left is mean-value method and right is fitting method)

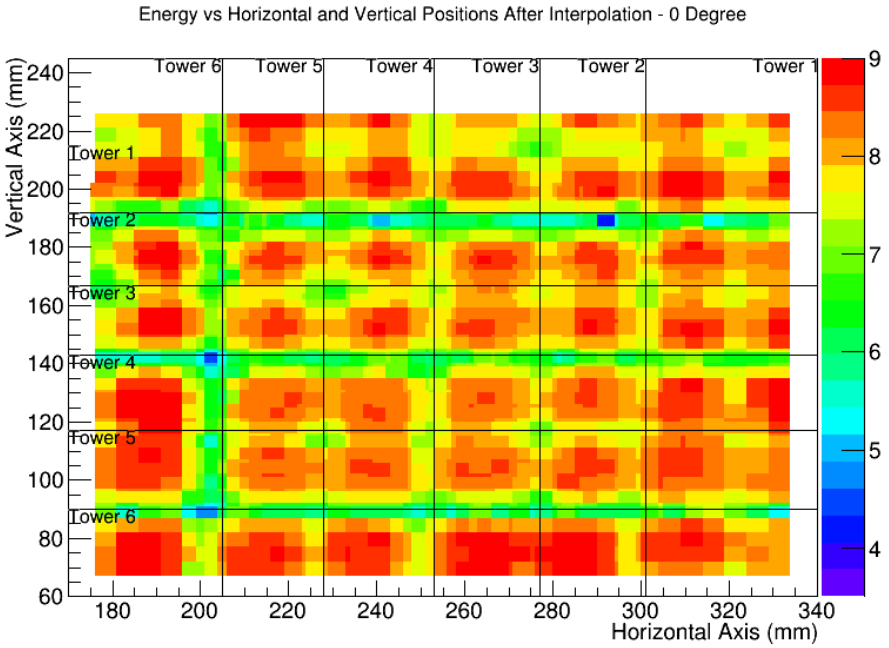




New Results After Calibration

0° Results (Left is mean-value method and right is fitting method)





Summary

- EMCAL position scan is carried out and the data are collected and analyzed
- Successfully develop programs to analyze EMCAL position scan data with two different calibrations
- Both mean value and Gaussian fitting methods are discussed
- Understand that EMCAL calibration makes towers (6,2), (6,3), (6,4) (5,2), (5,3) to have significantly lower mean energy